Lung recruitment maneuver

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Background

- Controversial in terms of safety and efficacy
  - No mortality/morbidity outcome benefits[1]
  - May be of more benefit to extra-pulmonary ARDS than to pulmonary ARDS
- Multiple methods reported
  - Below is only one method (Starcase Recruitment Maneuver)
  - Refer to your RT for hospital protocol
  - Proning patient is considered a recruitment maneuver
- **Indication:** severe ARDS < 1 wk, before onset of fibro-proliferation[2][3]
- Goals to recruit alveoli, maintain with PEEP at the derecruitment point, prevent cyclic collapse/VILI
  - Improving hypoxemia via recruitment
  - Decrease ventilator-induced lung injury (VILI)
- Derecruitment of alveoli occurs due to[4]:
  - Standard low TV ventilation in ARDS
  - Insufficient PEEP

    - High FiO2 absorptive atelectasis
- Biotrauma and cytokine release (VILI) occur due to:
    - Dependent areas of airway are collapsed throughout TVs
    - Cyclic collapse causes shear injury atelectrauma with each breath
    - Least dependent areas inflated throughout TVs are also easily hyperinflated causing volutrauma and barotrauma, especially in:
        - TVs > 6 cc/kg
        - Pplat > 30-35 cmH2O

Risks

- May only be temporary benefit
- Hemodynamic instability with drop off in preload
- CO2 retention
- May worsen oxygenation by shunting blood to poorly aerated lung (opposing physiological hypoxic pulmonary vasoconstriction)
- May worsen ventilator-induced lung injury with volutrauma/barotrauma
- Pneumothorax
- Contraindications
    - Unstable BP
    - pneumothorax or high risk of pneumothorax (blebs, necrotising pneumonia)
    - ARDS > 1 wk (relative contraindication)

Procedure[5]

- Goal is to find the **derecruitment point**

Failure

- Before attempting, know when the maneuver should be stopped
- Stop and return to baseline PCV settings if:
    - HR < 60 bpm
    - HR > 140 bpm
    - New dysrhythmia on monitor (may indicate significant respiratory acid-base shift)
    - SBP < 80 mmHg
    - Sustained SaO2 < 85%
    - Drop in dynamic compliance (pneumothorax)

Preparation

- May require increased sedation or paralysis
- Optimize preload (maneuver decreases preload)
- Maintain a very reliable, good waveform SpO2 (that matches ABG SaO2)
- 14 ga needles x2 in case of pneumothorax
- Record baseline vital signs and initial ventilator settings

    - I:E to 1:1
    - Adjust FiO2 to SaO2 90-92%
    - Take note of dynamic compliance levels
    - Pressure control ventilation using current rate, PEEP, FiO2 before maneuver
        - Adjust PC level above PEEP to start at TV of 6 cc/kg for 2 minutes
        - Then set PC level (Pi) to 15 cmH2O above PEEP and maintain this difference throughout initial recruitment
        - Adjust RR to maintain appropriate minute ventilation

Increasing PEEP

- Increase PEEP to 15 cmH2O
- Set PC level to 15 cmH2O above PEEP
    - Maintain this difference between PEEP and PC level (Pi)
    - Increase q2 minutes PEEP to 20 → 30 → 40 cmH2O
        - Pi will reach 55 cmH2O
        - Note maximum SaO2 obtained
        - Treat SBP drops as necessary, but halt procedure if > 20% SBP drop despite pressors/fluids
    - Increase PIP as necessary
        - Maintain minute ventilation
        - Reduce RR before PIP increase since TV will increase

Reducing PEEP

- Reduce q3 minutes PEEP to 25 → 22.5 → 20 → 17.5 cmH2O
- Remember that SpO2 monitor displays results up to 1-2 min after clinical change
- Until:
    - Decrease in SaO2 of 1% from maximum SaO2 observed, which is the **derecruitment point**
    - **OR** minimum of 15 cmH2O PEEP reached

Re-recruitment

- Increase PEEP step-wise q2 minutes to 40 cmH2O again
- Maintain PEEP at 40 cmH2O for 2 minutes
- Return to PEEP level 2-4 cmH2O above **decruitment point**
- Adjust TV 4-6 cc/kg and plateau pressures < 30 cmH2O
- Tolerate permissive hypercapnia if pH > 7.15
- May increase RR up to maximum of 38 bpm

Adjuncts

- Inhaled nitric oxide (iNO)
- Epoprostenol (prostacyclin) (Flolan)
- Extracorporeal membrane oxygenation
- High frequency oscillation ventilation (HFOV)

See Also

- Acute respiratory distress syndrome
- Mechanical ventilation (main)
- Ventilator associated lung injury

References

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